

REMARKS

Claims 1-3, 5, 6, 9-17, 36, and 38-46 are pending.

Claims 38-46 are rejected under 35 U.S.C. 112 as being indefinite. Applicants have amended the phrase objected to by the examiner.

Claims 10 and 42 are rejected under 35 U.S.C. 112 for failing to comply with the enablement requirement. The examiner states "the claims refer to a structure that is not described in the specification and is therefore not enabled. The specification describes the embodiments shown in Figures 1, 2, and 3, none of which correspond to these claims." Applicants respectfully traverse the rejection.

Claim 10 recites "bonding layer covers less than half of said layer of silver." Claim 10 is supported and enabled by the claim 12 originally filed in the parent application, which reads "The light emitting device of Claim 10 wherein said p-electrode further comprises a bonding layer comprising a metal chosen from the group consisting of gold and aluminum, said bonding layer being in electrical contact with said layer of silver, said bonding layer covering less than half of said layer of silver." The specification is amended to include the underlined material above. Since this material was included in the originally filed parent application as claim 12, this amendment adds no new matter.

Claim 42 recites "the barrier covers a first portion of the metal electrode; a second portion of the metal electrode is not covered by the barrier; and the first portion surrounds the second portion." Fig. 4 shows a TiO₂ layer 52 covering a first portion of silver layer 51. Layer 52 surrounds electrode metal layer 51A. Layer 52 is does not cover the portion of silver layer 51 that is covered by electrode metal layer 51A. Accordingly, claim 42 is enabled by Fig. 4 and accompanying text.

Claims 11 and 16 are rejected under 35 U.S.C. 112, first paragraph as containing subject matter that is not enabled. Claim 16 is canceled, rendering its rejection moot.

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GROUP LLP
2015 N. FIRST ST.
SUITE 225
SAN JOSE, CA 95134
(408) 382-0480
FAX (408) 382-0481

Regarding claim 11, the Examiner states "claim 11 describes a bonding layer as being multilayered but there is no disclosure describing the materials, number, or thickness."

Applicants respectfully point the Examiner to column 3, lines 17-19 which state "a second metal layer for bonding the p-lead wire 6 is constructed from nickel and gold and shown at 21A" and column 3 lines 47-50 which state "Next, about 300nm of nickel and 50 nm of gold are successively vapor-deposited and patterned to form electrode metal layer 21A for bonding to the p electrode" Applicants respectfully submit that the above-quoted passages specify the materials, number of layers, and thickness of each of the layers in a multi-layered bonding layer.

For the above reasons, Applicants respectfully request that the Examiner withdraw his rejections under 35 U.S.C. 112.

Claim 6 is rejected under 35 U.S.C. 132 for including new matter. Claim 6 is amended to delete the matter objected to by the Examiner.

Claims 1-3, 5, 6, 9-13, 15-17, 36, 38-43, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura et al., U.S. Patent 5,959,307 (hereinafter "Nakamura") in view of Kitagawa et al., U.S. Patent 5,616,937 (hereinafter "Kitagawa") and Mitsui, JP 02254765. Applicants respectfully traverse the rejection.

Claims 1 and 36 recite "the fixation layer is conductive." Regarding claims 1 and 36, the Examiner states: "Nakamura et al. show a GaN LED . . . with a p-contact that could be Ag . . . but does not show further layers. Kitagawa et al. show a luminescent device . . . that has a p-electrode 16 and a protective film 17 that protects the electrode [from] deterioration . . . Note that Kitagawa et al. show that layer 17 can be ZnS or ZnSSe (column 5, line 10) which is a semiconductor and is therefore conducting."

Applicants respectfully submit that the portion of the Examiner's argument underlined above mischaracterizes Kitagawa. The passage at column 5, lines 11-16 actually teaches:

"With the use of at least one kind of compounds including [list omitted] or with the use of at least one kind of mixtures of these compounds with ZnS or ZnS_xSe_{1-x}, as the protective film 17, it is possible to obtain a luminescent device with excellent heat resistance (100° C. or less) and excellent moisture resistance (90% or less)." Accordingly, the passage cited by the examiner does NOT teach that layer 17 can be a semiconducting ZnS or ZnSSe layer, it only teaches that layer 17 may include ZnS or ZnSSe mixed with other compounds. This passage does not teach a "conductive" fixation layer as recited in claims 1 and 36, and does not contradict Kitagawa's other teachings that "protective film 17" is "an insulating film." See, for example, Col. 4, lines 65-67. Since neither Nakamura nor Kitagawa teach a conductive fixation layer, claims 1 and 36 are allowable over these two references in combination.

To remedy the deficiencies of Nakamura and Kitagawa, the Examiner cites Mitsui, stating "Mitsui shows (see constitution) that for a solar cell a layer of Au on Ag will prevent deterioration of the Ag. It would have been obvious to protect the electrode as shown by Kitagawa et al. and to use Au as the protective film since it is easier to form than the semiconductor layer of Kitagawa et al." Office Action, page 4.

Applicants respectfully submit that Mitsui cannot be combined with Kitagawa because Mitsui's thin Au layer 5 and Kitagawa's protective film 17 serve different purposes, thus there is no motivation to turn to Mitsui to modify Kitagawa. Mitsui's thin Au layer 5 is to "prevent the surface of Ag from deteriorating [by] keeping it from being oxidized or sulfured due to exposure to the air . . . [T]he clean surface of Au is brought into contact with a connector at the welding of the connector, so that the connection of a connector high enough in bonding strength . . . can be realized. By this setup, a current blocking factor caused by oxide or sulfide can be eliminated, so that a stable welding can be made." Mitsui's gold layers thus preserves the electrical path to the silver contact, preventing oxidation or sulfuration that can harm current flow. In contrast, Kitagawa's protective layer is to protect the current injection

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GROUP LLP
2635 N. FIRST ST.
SUITE 223
SAN JOSE, CA 95134
(408) 362-0480
FAX (408) 362-0481

layer 14 and metal electrode 16 from deteriorating in an atmosphere where ultraviolet light is emitted. Neither Mitsui nor Kitagawa contain any suggestion that a layer designed to improve electrical contact to silver is suitable for protecting device layers from ultraviolet light. Accordingly, there is no motivation to substitute Mitsui's thin gold layer 5 for Kitagawa's protective film 17.

In addition, Applicants teach that a diffusion barrier is desirable because "in the absence of a diffusion barrier layer, gold from the bonding layer diffuses into the silver layer and reduces the reflectivity of the silver layer." See page 7, lines 11-12. Accordingly, substituting Mitsui's thin gold layer 5 for Kitagawa's protective film 17 and forming the thin gold protective film on Nakamura's III-nitride silver contact light emitting device would result in a structure having the very gold-diffusing-into-the-silver-electrode problem that the diffusion barrier of the present invention attempts to remedy.

Since there is no motivation to combine Mitsui with Nakamura and Kitagawa, claims 1 and 36 are allowable over the combination of these references. Claims 2, 3, 5, 6, 9, 10, 12-14, 15, and 17 depend from claim 1 and are thus allowable for at least the same reasons as claim 1. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura, Kitagawa, and Mitsui, further in view of Hatano et al. Hatano adds nothing to the deficiencies of Nakamura, Kitagawa, and Mitsui, thus claim 14 is allowable for at least the same reason as claim 1.

Claim 38 recites "a diffusion barrier overlying the metal electrode for preventing migration of metal from the metal electrode." Regarding claim 38, the Examiner states "Since Ag is also subject to deterioration it would have been obvious to provide a protective film on the Nakamura et al. device. Mitsui shows (see constitution) that for a solar cell a layer of Au on Ag will prevent deterioration of the Ag. It would have been obvious to protect the electrode as shown by Kitagawa et al. and to use Au as the protective film since it is easier

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GROUP LLP
2535 N. PIERCE ST.
SUITE 223
SAN JOSE, CA 95134
(908) 382-0480
FAX (408) 382-0481

to form than the semiconductor layer of Kitagawa et al.” Applicants respectfully traverse the rejection.

Applicants respectfully request that the Examiner cite a reference that teaches that “Ag is subject to deterioration.” Applicants have found no such teaching in the passages of Nakamura cited by the Examiner.

Even assuming, arguendo, that it is well known that silver is subject to deterioration, Applicants respectfully submit that a person of skill in the art would not be motivated to turn to Kitagawa or Mitsui to form a diffusion barrier for preventing migration of metal from the metal electrode, since neither reference is concerned with that particular form of deterioration, i.e. metal migration. As described above, Kitagawa’s protective film is designed to protect the device from deteriorating in an atmosphere where ultraviolet light is emitted. Mitsui’s thin gold layer is designed to preventing a contact from oxidizing or sulfurating, since such oxidation or sulfuration can impede current flow to the contact. Accordingly, there is no motivation to combine Kitagawa or Mitsui with Nakamura’s device, and claim 38 is allowable over this combination of references. Claims 39-46 depend from claim 38 and are thus similarly allowable.

Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura, Kitagawa, and Mitsui, further in view of Hatano et al. Hatano adds nothing to the deficiencies of Nakamura, Kitagawa, and Mitsui, thus claim 46 is allowable for at least the same reason as claim 38. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura, Kitagawa, and Mitsui, further in view of Shibata. Shibata adds nothing to the deficiencies of Nakamura, Kitagawa, and Mitsui, thus claim 44 is allowable for at least the same reason as claim 38.

PATENT LAW
GROUP LLP
2635 N. FIRST ST.
SUITE 223
SAN JOSE, CA 95134
(408) 352-0480
FAX (408) 352-0481

In view of the above arguments, Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions, the Examiner is invited to call the undersigned at (408) 382-0480.

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Respectfully submitted,

R. Leiterman

Rachel V. Leiterman
Attorney for Applicant(s)
Reg. No. 46,868

PATENT LAW
GROUP LLP
2035 N. FIRST ST.
SUITE 225
SAN JOSE, CA 95134
(408) 382-0480
FAX (408) 382-0481